CLAIMS

What is claimed is:

1. A system that delays a signal, comprising:

a first component comprising:

a reservoir with a reflective fluid;

a optical fiber that is operative to the reservoir;

a second component that facilitate continuous movement of the reflective fluid from the reservoir to a location within the fiber to adjust the effective length of the fiber, the effective length of the fiber corresponding to a desired delay, wherein the signal is delayed *via* routing the signal through the effective length of the fiber.

2. The system of claim 1, further comprising a first and second plate and a retaining ring that surround the reservoir and the fiber to maintain the reservoir proximate to the fiber.

3. The system of claim 1, the fiber constructed to accept one of a single mode optical signal and a multimode optical signal.

4. The system of claim 1, the fiber comprising a hollow core and a photonic crystal cladding comprising a plurality of air holes.

5. The system of claim 1, the fiber comprising a core with an optical transmission medium comprising air, a vacuum or a fluid immiscible with the reflective fluid.

6. The system of claim 1, further comprising an overflow reservoir operative to the fiber to mitigate at least one of loss of reflective fluid and contamination of the reflective fluid.

7. The system of claim 1, the second component employing at least one of a pressure and temperature mechanism to facilitate reflective fluid flow within the fiber.

8. The system of claim 7, the pressure mechanism comprising a segmented piezoelectric device that includes a plurality of actuators.

9. The system of claim 8, the plurality of actuators activated in a commutated manner to continuously vary the reflective fluid within the fiber.

10. The system of claim 1, the first and second components assembled into a continuously variable delay line device that is 6 cm by 1 cm.

11. The system of claim 1, the fiber comprising an 8 micron diameter hollow core, six 32 micron diameter holes and a 125 micron diameter cladding.

12. The system of claim 1, employed in an aerospace application.

13. The system of claim 1, the reflective fluid selected to achieve a reflective index mismatch between an optical medium within the fiber and the reflective fluid to provide for at least one of low lossand wavelength band-limiting.

14. The system of claim 1, the signal comprising one of an optical signal and a radio frequency (RF) signal converted to an optical signal.

15. The system of claim 1, the fiber configured in a spiral layout, wherein one end of the spiral is operative to the reflective fluid reservoir and the other end is operative to a signal input port.

16. A method to delay a signal, comprising:

configuring a delay line for a desired delay;

receiving a signal at an input port; and

routing the received signal through the delay line, wherein the signal traverses the delay line until it becomes incident with a reflective fluid where the signal reflects off the surface of the reflective fluid back to the input port, the distance traveled by the signal corresponding to the delay introduced into the signal.

17. The method of claim 16, the delay line comprising an optical fiber with one of an air, vacuum or immiscible fluid core, the fiber having an adjustable effective length, wherein a pressure device is employed to position the reflective fluid within the fiber in a continuous manner to define the effective length of the fiber, the effective length indicative of the delay.

18. The method of claim 17, the optical fiber constructed to accept one of a single mode optical signal or a multimode optical signal.

19. The method of claim 18, the optical fiber comprising an inner core and an outer cladding, the cladding comprising a plurality of air holes, wherein the inner core is 8 microns in diameter, the outer cladding ins 125 microns in diameter, and the plurality of air holes are 32 microns in diameter.

20. The method of claim 16, further employing an overflow reservoir operative to a reflective fluid reservoir through the delay line to mitigate at least one of loss of reflective fluid and contamination of the reflective fluid.

21. The method of claim 16, the pressure device comprising a segmented piezoelectric component that includes a plurality of actuators.

22. The method of claim 16, further comprising a temperature device to facilitate positioning the reflective fluid within the delay line.

23. The method of claim 21, the plurality of actuators activated in a commutated manner to continuously vary the reflective fluid within the delay line.

24. The method of claim 16, employed in an aerospace application.

25. The method of claim 16, the reflective fluid selected to achieve a reflective index mismatch between the medium within the delay line and the reflective fluid to provide for low loss and/or wavelength band-limiting.

26. The method of claim 16, the signal comprising one of an optical signal and a radio frequency (RF) signal converted to an optical signal.

27. The method of claim 17, the optical fiber configured in a spiral layout, wherein one end of the spiral is operative to a reflective fluid reservoir and the other end is operative to a signal input port.

28. A signal delay system, comprising:

means for defining a delay to introduce into a received optical signal;

means for routing the optical signal through a holey fiber to delay the signal.

29. The system of claim 28, further comprising means for continuously propagating a reflective fluid through the holey fiber to a desired location to increase or decrease the delay.

30. The system of claim 29, the reflective fluid selected to provide a suitable reflective index mismatch and the signal routed at an angle of incidence to achieve total internal reflection to provide for a low loss system.